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[Continued on next page]

# (54) Title: APPARATUS FOR EUV IMAGING AND METHODS OF USING SAME

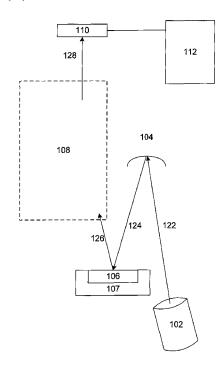


FIG. 1

<u>100</u>

(57) Abstract: One embodiment relates to an apparatus that includes an illumination source (102) for illuminating a target substrate (106), objective optics (108) for projecting the EUV light which is reflected from the target substrate, and a sensor (110) for detecting the projected EUV light. The objective optics includes a first mirror (202,302, or 402) which is arranged to receive and reflect the EUV light which is reflected from the target substrate, a second mirror (204, 304, or 404) which is arranged to receive and reflect the EUV light which is reflected by the first mirror, a third mirror (206, 306, or 406) which is arranged to receive and reflect the EUV light which is reflected by the second mirror, and a fourth mirror (208, 308, or 408) which is arranged to receive and reflect the EUV light which is reflected by the third mirror.

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### A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC

#### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) eKOMPASS(KIPO internal) & Keywords: EUV, mask, mirror, concave, convex, inspection

#### C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2005-0201514 A1 (HANS-JURGEN MANN et al.) 15 September 2005 See abstract, pages 1-10 and claims 1-57.	1,4,6,8,18 2,3,5,7,9-17,19,20
A	US 2002-0017616 A1 (KAZUYA OTA) 14 February 2002 See abstract, pages 1-8 and claims 1-27.	1-20
A	US 6549270 B1 (KAZUYA OTA) 15 April 2003 See abstract, columns 1-20 and claims 1-87.	1-20
A	US 2009-0267003 A1 (MASATO MORIYA et al.) 29 October 2009 See abstract, pages 1-12 and claims 1-16.	1-20

	Further documents are l	listed in the	continuation	of Box C.
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See patent family annex.

- \* Special categories of cited documents:
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Date of mailing of the international search report

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## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005-0201514 A1	15,09,2005	AU 2003-268097 A1	11.11.2003
		EP 1446813 A2	18.08.2004
		EP 1446813 B1	10.11.2010
		EP 1455365 A2	08.09.2004
		JP 04639352 B2	10.12.2010
		JP 2005-525565 A	25.08.2005
		JP 2010-032542 A	12.02.2010
		US 7623620 B2	24.11.2009
		WO 03-096356 A2	20.11.2003
		WO 03-096356 A3	20.11.2003
US 2002-0017616 A1	14.02.2002	JP 11-345761 A	14. 12. 1999
		US 6485153 B2	26.11.2002
US 6549270 B1	15.04.2003	JP 2000-286189 A	13.10.2000
US 2009-0267003 A1	29.10.2009	JP 2010-004001 A	07.01.2010
		JP 2010-004002 A	07.01.2010
		US 2009-0289205 A1	26.11.2009
		US 8198613 B2	12.06.2012
		US 8227778 B2	24.07.2012